

HIGHWAY DESIGN	Chapter PAVEMENT
	Subject Pavement Design

Summary:

Pavement design is an integral part of the project decision process. The Project Team should discuss, consider, and document the pavement design as it relates to the overall project. The pavement is typically one of the major costs of a project. The pavement design affects maintenance of traffic, constructability, the environment, as well as other aspects of the project.

This chapter outlines policies determining who designs a pavement structure, who approves the design and the accepted practices for specific pavement conditions. The pavement design for a project is determined by the volume and composition of traffic, soil conditions, availability of materials and costs (initial and life cycle). Information required for pavement design includes traffic data and axle loads from the Division of Multimodal Programs and the soil characteristics from the Division of Materials. The designer is advised to request this information as soon as possible. The procedures for determining pavement layer thickness and composition are provided in the *Pavement Design Guide* issued by the Division of Highway Design.

PAVEMENT DESIGN

RESPONSIBILITY: Based on the criteria listed below, the project team will determine if the pavement is to be designed by District or Consultant personnel or by the Pavement Branch of the Division of Highway Design.

Criteria*	Design Responsibility	Submitted By	Approved by
NHS, Structural Overlays ≥ 20 million ESALs, ≥ 15,000 ADT, and ≥ 20% Trucks	Central Office Division of Highway Design Pavement Design Branch	Central Office Division of Highway Design Pavement Design Branch	Central Office Division of Highway Design And if required, State Highway Engineer & FHWA
< 20 million ESALs, Off the NHS, < 15,000 ADT, and < 20% Trucks	Project Designer	District TEBM for Preconstruction to Central Office	Central Office Division of Highway Design Pavement Design Branch
≤ 5 million ESALs and ≤ 1 mile,	Project Designer	Project Designer to District TEBM for Preconstruction	District TEBM for Preconstruction

* Average Daily Traffic (ADT) and Percent Trucks are current data. Equivalent Single Axle Loads (ESALs) are for a 20 year design. NHS is the National Highway System.

**NHS, Structural Overlays, ≥ 20 million ESALs,
≥ 15,000 ADT, and ≥ 20% Trucks:**

For pavement designs that are to be designed by Central Office Division of Highway Design, the project manager shall submit a written request for a pavement design to the Transportation Engineering Branch Manager (TEBM) of the Division of Highway Design Pavement Branch.

**Less than 20 million ESALs,
But Greater Than 5,000,000
ESAL's or 1 Mile:**

The district TEBM for Pre-construction will recommend the design to the Pavement Design Branch and forward it to the Central Office Division of Highway Design. Documentation and justification supporting the selection of a specific pavement type (Asphalt vs. PCC) must be included in the submittal to the Central Office along with supporting economic analysis.

The TEBM for Pavement Design will approve the design. The Pavement Branch staff in the Division of Highway Design will be responsible for distribution of the approved pavement design for these projects. The distribution list includes the Location Engineer, Plan Processing Section, and the consultant, if necessary. The Project Manager will be responsible for submitting an updated TC 61-29E form when final plans are submitted to the Central Office Division of Highway Design.

**Less Than or Equal to
5,000,000 ESAL's and
Less or Equal Than 1 Mile:**

Pavement designs prepared by a Consulting Engineering Firm are to be submitted to the District. The District will forward the pavement design (whether designed by a consultant or by district personnel) to Central Office Pavement Design for archival and pavement management purposes and if necessary for review of pavement type selection justification.

If designing a pavement for a new location or if the proposed pavement type is different than the existing pavement, the pavement type selection must be approved by the Branch Manager for Pavement in the Division of Highway Design. Documentation and justification supporting the selection of a specific pavement type (Asphalt vs. PCC) must be included in the submittal to the Central Office along with supporting economic analysis.

The Project Manager will be responsible for distribution of the approved pavement design for these projects. The distribution list includes the Location Engineer, Plan Processing Section, and the consultant, if necessary.

**PAVEMENT DESIGN
SUBMITTAL
FOLDER:**

Submit the pavement design folder to the district T.E.B.M. for Pre-construction for approval or recommendation. The Project Manager will submit all pavement designs to the Pavement Design Branch of the Division of Highway Design for review and record keeping. The review will examine pavement type justification, pavement bid items, and format. Central office returns the comments to the Project Manager. The Project Manager will forward the comments to the project engineer or the consultant. In order to ensure a proper pavement type selection, a consistent format, and an appropriate use of bid items, the Pavement Design Branch will review and provide comments on pavement designs, regardless of who is responsible for approval.

The pavement design folder shall include the following:

- TC 61-29E form, *Pavement Design* (Exhibit 600-01)
- Design Executive Summary
- Typical sections and details
- Design calculations
- Cost Comparison of alternatives
- Pavement type selection justification
- Geotechnical information (indicate if estimated)
- Traffic information (show calculations if estimated)
- Special notes and provisions
- Other documentation, if available and applicable

Pavement type selection justification and economic analysis are required.

**PAVEMENT
QUANTITIES:**

Use the Department's standard summary sheets for "PAVING AREAS" and "PAVING QUANTITIES" in the preparation of plans. See Weight Factors Exhibit 600-02 and Example Pavement Details in Exhibits 600-03 and 600-04 for estimating pavement quantities.

When there are multiple pavement mixtures and the quantity of any specific mixture amounts to less than 1000 tons, substitute a similar mixture on the project that has a quantity greater than 1000 tons or use the mainline mixture type. Minimize the number of mixtures in this manner when possible. Special consideration should be given to intersections of different classification of roadways.

**Structural
Overlays:**

A structural overlay consists of more than a surface course plus leveling and wedging. It is intended to extend the structural life of the pavement. The project manager shall submit a written request for a structural overlay design to the Transportation Engineering Branch Manager (TEBM) of the Division of Highway Design Pavement Branch

**ENTRANCES,
ACCESS ROADS,
AND
APPROACHES:**

The paving limits for entrances, access roads, and approaches should be the tie-down point, limits of the Right of Way, or other points as determined by the Project Team. For more guidance on paving limits, see Standard Drawing No. RPM-110, current edition.

The existing pavement type is generally used for entrances. Pave entrances with a 10% grade or steeper. Use the *Pavement Design* Table below for minimum pavement depths. When greater pavement depths are warranted, refer to the *Pavement Design Guide*.

For curb and gutter sections with sidewalks, use PCC entrance pavement in accordance with the current *Standard Drawing*. From the back of the sidewalk line, replace the existing pavement with one of the same type and depth if it exceeds the *Pavement Design* Table below.

For access roads and minor approaches, it is generally desirable to pave with the mainline design to the back of the radius or touch down point if the distance from the end of radii to the touchdown point is less than 100 feet. For distances greater than 100 feet, refer to the *Pavement Design Guide* or the *Pavement Design* Table below. The selected pavement design should be structurally equivalent or better than the existing

**PAVEMENT DESIGNS⁽¹⁾ FOR
ENTRANCES, FRONTAGE ROADS, ACCESS ROADS,
And MINOR APPROACHES**

DESCRIPTION	AGGREGATE BASE ⁽²⁾ (inches)	ASPHALT ⁽³⁾ BASE SURFACE (inches) (inches)		RIGID PCC (inches)
ENTRANCES				
RESIDENTIAL	4	2	1-1/4	8 on 4 DGA
COMMERCIAL	6	2	1-1/4	8 on 4 DGA
FRONTAGE ROADS, ACCESS ROADS and MINOR APPROACHES				
RESIDENTIAL or COMMERCIAL and MINOR APPROACH ROADS	8	3	1-1/4	8 on 4 DGA

1. The pavement designs shown are suggested minimums.
2. Use the same aggregate type as used on the mainline.
3. Surface and base mixture designs should be consistent with other designs used on project. Small quantities (generally less than a 1000 tons) of mixtures different than used on the project should be avoided.

SHOULDERS: Show the shoulder pavement thickness in the pavement design document. For those sections with a two-foot paved shoulder and the remainder an earth shoulder, use the mainline pavement structure for the shoulder. The cross slope for the two-foot paved shoulder is to be the same as the main line pavement. Do not use full-width DGA shoulders.

NOTE: Extend the surface course under the guardrail when wedge curb is required. Where the usable shoulder is paved and guardrail is used, the project team may want to consider paving to the face of rail for ease of maintenance and mowing.

When using aggregate at the outside edge of the paved shoulders, an asphalt seal is required from the outside edge of the paved shoulder to a point at least two feet down the ditch or fill slope. See Pavement Design Guide for more details.

**PAVED
SHOULDERS AT
BRIDGE ENDS:**

Paved shoulders are to be used at bridge ends for all bridge and approach projects as a means of minimizing erosion at bridge ends. See Standard Drawing No. RBB-001 and RBB-002, current edition, for details on shoulder paving at bridge ends.

INTERSECTIONS: Intersections may require special design consideration. See Pavement Design Guide for more details.

**ON SITE
DETOURS**

(DIVERSIONS): The pavement design of detours should be determined from project specific conditions like duration and traffic. A minimum pavement design is one inch of asphalt surface, one and one half inches of asphalt binder and four inches of DGA base. Traffic Bound Base (approximately 6 inches to 8 inches) will be permitted for detours with less than 400 ADT and with a service life less than 30 days. If any one course type (base, binder or surface) amounts to less than 1000 tons total for the project, substitute the mainline mixture type (or the minimum mixture type used on the project) for that course type.

PROJECT

TIE-INS: Project tie-ins shall be as follows:

THIN OVERLAYS: For projects with 1-1/2 inches overlays or less, the asphalt concrete surface is to be carried full thickness into the existing pavement or bridge end. Mill the existing asphalt pavement to tie into the existing pavement surface course at a 1-inch to 15-inch taper (see Edge Key Exhibit 06-05).

THICK OVERLAYS: For projects with thicker overlays (greater than 1-1/2 inches), tie-in to the existing pavement as follows:

Rigid Pavement (existing):

Remove the existing pavement through the taper area, backfill as necessary and pave as shown in the pavement design at a 1-inch to 100 feet taper.

Flexible Pavement (existing):

Mill the surface as required to extend the asphalt surface course full depth into the existing adjacent pavement at a 1-inch to 100 feet taper (see Tapering of Thick Overlays Exhibit 06-06).

PARKING LOTS: Pavement designs for parking lot should be addressed on a project by project basis.

CONCRETE PAVEMENT

JOINTS: Standard Drawings (the RPN and RPS series) depict the typical conditions for cement concrete pavement joints, types and spacing. For projects where these standard joint placements are not practical or desirable, joint details shall be a required component of the construction plans. For more detail, see Pavement Design Guide and **Standard Specifications for Road and Bridge Construction**.

**PAVEMENT
MARKINGS:**

Pavement markings are to conform to the Standard Drawings TTC, TPM, TTD and TTS series. Also, refer to other guidance by the Division of Traffic and in the ***Manual on Uniform Traffic Control Devices***.